The Impact of Population Aging in the Central and Western Regions on Rural Residents' Health Expenditure

-- An Empirical Analysis based on Panel Data of 22 Provinces from 2000 to 2017

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Abstract

Objective: To explain the impact mechanism of population aging in the central and western regions on the per capita health care expenditure of rural residents during the social transition period. Methods: Using econometric analysis methods, the article uses the population dependency ratio as a measurement indicator of population aging, constructs random effect and time effect models, and conducts an empirical analysis of the panel data of 22 provinces in the central and western regions from 2010 to 2017, and the GMM model is used to test the robustness of the empirical results. Results: Population aging in the central and western regions, rural residents' per capita disposable income, medical and family planning expenditures have a significant positive impact on rural residents' per capita health care expenditures; the impact of population aging on rural residents' per capita health care expenditures has regional heterogeneity sex. Conclusion: It is necessary to adopt a proactive population birth policy, improve the social old-age medical security system, and promote the coordinated development of the regional economy, so as to improve the accessibility of medical and health services for rural residents in the central and western regions.

Keywords

Central and Western Regions; Population Aging; Rural Residents; Medical Care.

1. Introduction

The per capita health care expenditure of rural residents is an important indicator for evaluating the purchasing capacity of rural residents and the accessibility of social medical and health services. The key work areas for promoting "healthy poverty alleviation" and realizing the "Healthy China 2030" strategy are in the poor rural areas of the central and western regions, especially in the central and western regions. In the context of China's aging population, in the rural areas of the central and western regions where economic development is relatively backward. How to reduce the purchase burden of rural residents' medical access to health care services is an important issue to achieve a well-off society in an all-round way. In the second decade of the twentieth century, China experienced the phenomenon of population aging [1]. Due to the long-term implementation of the family planning policy, China's aging problem has shown a rapid and irreversible trend, and the rapid increase in the elderly population will continue to expand the demand for medical care for the elderly [2]. With the continuous transformation and upgrading of China's society, the impact of population aging on the enjoyment of basic health care services (accessibility) by social residents, especially the elderly population, has become an important aspect of the effective supply of basic public services by government departments.

Previous studies have found that an aging population will lead to an increase in healthcare costs [3]. Specifically, the coefficient of old-age dependency, GDP per capita, and the actual amount of per capita investment by the state and society in terms of health expenditure have a positive impact on the health care expenditure of residents [4]. And the aging of the population has a positive impact on the health care expenditure of the elderly population [5]. The reason is that the poor health of the elderly has led to an increase in health care spending on aging [6].In addition, some scholars have confirmed that there are regional differences [7,8]. The above shows that there is a correlation between population aging and social spending on basic medical care. The article believes that in the historical intersection of continuous social development and deepening social aging, the base of the rural elderly population in the central and western regions is increasing, which will promote the continuous rise of medical care expenditure of the rural elderly population.

Therefore, based on the panel data of 22 provincial-level regions in central and western China from 2000 to 2017, this paper conducts an empirical analysis to explore the impact of population aging (population dependency ratio as an indicator) on residents' health care expenditure. Explore regional heterogeneity by comparing different regions (central, western). Provide countermeasures and suggestions for building a complete social health care service system and improving the accessibility of health services for rural residents in the central and western regions.

2. Model Design

2.1. Data Sources

The data type in this article is panel data for 18 years in 22 provincial regions in the Central and Western Regions from 2010 to 2017. The sample had a total of 396 observations, including 22 cross-sectional units (id) and 18 years of time series (year) data. The empirical data of the article comes from the China Statistical Yearbook, the China Health Statistical Yearbook and the Chinese and Employment Statistics Yearbook, and the data are rigorous and reliable. The empirical part of this paper was statistically analyzed using Stata14.0 software.

2.2. Variable Descriptions

The article focuses on the impact of population aging in the Midwest on rural residents' health care spending. The article takes the annual per capita health care expenditure of rural residents as the dependent variable, takes the population aging as the core independent variable, and adds two independent variables of the annual per capita disposable income of rural residents in the region, the annual medical and family planning expenditure of the region, the four control variables of the regional year-end GDP, the total number of permanent residents at the end of the year, the local annual public financial investment, and the number of health institutions, and constructs a panel data model to explore the aging population in the central and western regions, the annual per capita disposable income of rural residents, and the annual per capita disposable income of rural residents, the impact of medical and family planning expenditure on rural residents' health care expenditure. At the same time, in order to make the data distribution more stable and the empirical results more stable, in addition to the population dependency ratio, the values of the relevant variables are logarithmic processed, see Table 1.

Table 1. Variable Definition and Description

Variable type	Variable code	Variable name	Variable definitions	Data sources
Dependent variable	*Ln-perh*	The logarithm of the annual per capita	The total amount of annual expenditure on health care per	China Health Statistical Yearbook

		medical health care expenditure of rural residents (yuan)	capita of rural residents, reflecting their spending power on health care	
Independent variable	Pdr	Aging population	Select the dependency ratio of the population aged 65 and over in the region to reflect the social impact of the aging population in the region	China Statistical Yearbook, China Population and Employment Statistical Yearbook
	Ln-peri	The logarithm of the annual per capita disposable income of rural residents (yuan)	Annual disposable income of rural residents in the region/total number of people in the region at the end of the year, reflecting the per capita consumption level of residents in the region	China Statistical Yearbook
	Ln-phy	The logarithm of annual medical and family planning expenditure in the region (100 million yuan)	The total expenditure on medical care and family planning at the end of the year in the region reflects the investment in the medical and health services of the region	China Statistical Yearbook
Control variable	Ln-gdp	Regional year-end GDP (100 million yuan) logarithm	Regional GDP at the end of the year, reflecting the level of regional economic development	China Statistical Yearbook
	Ln-mup	The logarithm of the total resident population at the end of the year (10,000 people)	Reflect the population base of the region	China Statistical Yearbook
	Ln-pfi	The logarithm of the local annual public financial investment (100 million yuan)	The total budget expenditure of the region at the end of the year, reflecting the investment in public utilities in the region	China Statistical Yearbook
	Ln-nhi	The logarithm of the number of regional health institutions (number)	The total number of medical institutions in the region at the end of the year, reflecting the basic situation of the regional medical service capacity	China Statistical Yearbook, China Health Statistical Yearbook

2.3. Model Settings

This paper uses a random effect model to analyze the impact of independent variables on the per capita annual health care expenditure of rural residents. The specific regression model is as follows:

$$Y_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots\ldots + \beta_k Control_{ik} + \varepsilon_i$$

Among them: Y_i represents the dependent variable; X_{ij} is the respective variable, including the control variable $Control_{ik}$, j=1, 2, ..., k; α is the constant term (intercept); ε_i is the independent and identically distributed random error term; β_1, β_2... β_k is estimate coefficients for the model.

3. Model Testing

Based on the official database, the article constructs panel data for 18 years in 22 provincial-level regions in the Midwest from 2010 to 2017. Firstly, the article tests the correlation between the dependent variable and the independent variable; secondly, the descriptive statistics of the variable values are carried out; thirdly, the stationarity test of the data (LLC, IPS, Hadri LM) is

carried out; Estimation methods (fixed effect model, random effect model) and Hausman test results, selected random effect model and supported by OLS, time effect model for empirical analysis, and used the system GMM model to test the results.

3.1. Descriptive Statistics

There are 396 observation points in the panel data. Since the data comes from the official database, the mean, standard deviation, minimum and maximum values of the variables are all within the acceptable range,see Table 2.

Table 2. Variable Descriptive Statistics

Variable name	Observations	Mean	Standard deviation	Minimum value	Maximum value
Ln-perh	396	5.457	0.943	2.777	7.154
Pdr	396	11.869	2.665	6.7	20.6
Ln-peri	396	8.365	0.644	7.194	9.533
Ln-phy	396	4.144	1.407	0.854	6.729
Ln-gdp	396	8.509	1.181	4.766	10.704
Ln-mup	396	7.987	0.9	5.56	9.182
Ln-pfi	396	6.978	1.232	1.81	9.07
Ln-nhi	396	9.541	1	7.12	11.307

3.2. Model Regression

Table 3. Regression Analysis

Variable	M1	M2	M3	M4
	OLS	Random effects	Time effect	SYS-GMM
L1.Ln-perh				0.6275***
				(0.0741)
Pdr	0.0314*	0.0314***	0.0206***	-0.0044
	(0.0176)	(0.0067)	(0.0072)	(0.0031)
Ln-peri	0.9233***	0.9233***	0.1823	0.4044***
	(0.1339)	(0.0607)	(0.1712)	(0.1074)
Ln-phy	0.1726*	0.1727***	0.2147***	-0.0058
	(0.0943)	(0.0388)	(0.0495)	(0.0205)
Ln-gdp	0.0947	0.0947*	0.0777	0.1356***
	(0.0674)	(0.0487)	(0.0556)	(0.0386)
Ln-mup	-0.1495	-0.1496**	-0.0739	-1.0747
	(0.1353)	(0.0702)	(0.0802)	(1.1302)
Ln-pfi	-0.0341	-0.0341	-0.1234***	0.0046
	(0.0709)	(0.0263)	(0.0346)	(0.0223)
Ln-nhi	-0.0264	-0.0264	0.0107	0.0038
	(0.0292)	(0.0217)	(0.0233)	(0.0169)
_cons	-2.4754***	-2.4754***	2.7201**	6.1857
	(0.7627)	(0.6596)	(1.2850)	(8.7234)
chi2	7145.09***	12399.00***	15093.11***	185036.33***
R^2	0.9729	0.9729	0.9789	
Sargan Test				19.2381
AR(1)				-3.3835***
AR(2)				-0.78296
N	396	396	396	374

Note: Standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Model 1-Model 4 adopts OLS, random effect, time effect, and systematic GMM regression method to realize empirical analysis and robustness test. First, the regression results of Model 1-Model 3 show that Pdr has a significant positive impact on Ln-perh (P<0.1), and the impact coefficients are 0.0314, 0.0314, and 0.0206, respectively, that is, the population aging in the central and western regions has a significant impact on rural residents' healthcare expenditures has a significant positive impact; secondly, in model 1-model 2, Ln-peri has a significant positive impact on Ln-perh (P<0.01), and the influence coefficients are both 0.9233, that is, the per capita disposable income of rural residents in the central and western regions has a significant positive impact on its health care expenditure, which verifies the research of Cao Yang and Dai Yujuan [9]; thirdly, the regression results of model 1-model 3 show that Ln-phy has a significant positive impact on Ln-perh (P<0.1), the impact of The coefficients are 0.1726, 0.1727, and 0.2147, respectively, which means that medical and family planning expenditures in the central and western regions have a significant positive impact on rural residents' health care expenditures, which supports Xu Mingjiang's research [10]. Finally, model 4 adopts the system GMM model, and combines Sargan test and Abond test to test the endogeneity of model 1-model 3. The results show that there is no variable endogenous problem in the benchmark regression, and the results of model 1-model 3 are more robust and credible. The R^2 of model 1-model 3 are all greater than 0.9, and the model has strong explanatory power, see Table 3.

3.3. Regional Heterogeneity Analysis

Table 4. Regional Heterogeneity Analysis

Variable	Central region		Western region	
	M5	M6	M7	M8
Pdr	-0.0026 (0.0120)	-0.0050 (0.0118)	0.0574** (0.0258)	0.0498** (0.0218)
Ln-peri	1.2856*** (0.0882)	1.3009*** (0.1149)	0.9003*** (0.1471)	0.8622*** (0.1364)
Ln-phy	0.0664 (0.0426)	-0.0514 (0.0912)	0.1565 (0.0512)	0.1527* (0.0868)
Ln-gdp		0.0565 (0.0661)		0.1937** (0.0845)
Ln-mup		0.0330 (0.1097)		-0.2569 (0.2095)
Ln-pfi		0.0849*** (0.0255)		-0.0678 (0.0745)
Ln-nhi		0.0361 (0.0379)		-0.0598* (0.0356)
_cons	-5.6330*** (0.6008)	-6.9678*** (2.0089)	-3.3399*** (0.7145)	-1.5020* (0.8936)
chi2	2030.30***	4156.54***	1426.28***	6549.60***
R^2	0.9788	0.9797	0.9715	0.9740
N	180	180	216	216
Pdr	-0.0026 (0.0120)	-0.0050 (0.0118)	0.0574** (0.0258)	0.0498** (0.0218)

Due to differences in social development level, ethnic culture, etc., the central and western regions need to be classified and investigated. Therefore, the paper divides the panel data into two subsamples in the central and western regions, and performs random effects model regression. The regression results of Model 5 and Model 6 on the sub-sample in the central

region show that the impact of Pdr on Ln-perh is not statistically significant at the 10% level, that is, the impact of population aging in the central region on rural residents' healthcare spending Not obvious. The model regression results of the western sub-sample of Model 7-Model 8 show that Pdr has a significant impact on Ln-perh (P<0.05), that is, the impact of population aging in the western region on rural residents' health care expenditure is very significant. Therefore, there is regional heterogeneity in the significant impact of population aging on rural residents' healthcare expenditures. In addition, the per capita disposable income in the central and western regions has a significant positive impact on the medical care needs of rural residents, and there is no regional heterogeneity, see Table 4.

4. Policy Implications

First, continuously optimize the socio-demographic structure of the central and western regions, and reduce the expenditure burden of rural residents on basic medical care services. "Demographic dividend" has always been an important factor in the leap-forward development of my country's economy. With the long-term implementation of the "one-child" policy of family planning, the population growth has shown the characteristics of "low birth rate, low mortality rate and low natural growth rate", and the social demographic structure of our country has undergone great changes: the proportion of the working-age population has been declining, and the elderly population keeps rising. The advantages of economic development brought about by the "demographic dividend" have also gradually diminished, and the results of previous economic development are mainly concentrated in the eastern coastal areas. At the same time, with the evolution of urbanization, relatively low-income "vulnerable groups" stay in rural areas, which is very unfavorable for the central and western regions with low economic development level to ease the huge social pressure on the cost of basic medical care services for rural residents in the future. Based on this phenomenon and the above empirical conclusions, this paper believes that it is necessary to optimize the social demographic structure in the central and western regions in a timely manner to fundamentally respond to the expected pressure of economic development and rural residents' basic medical care services under the background of country's aging population. The specific measures include three aspects: First, the "comprehensive two-child" birth policy should be vigorously advocated to increase the birth rate in the central and western regions. The "comprehensive two-child policy" is conducive to reducing the aging rate of the population, optimizing the age structure of the social population, and by cultivating "new forces" to shoulder the heavy responsibility of future social development, to achieve sustainable social development; second, continue to promote the construction of new urbanization in the central and western regions, and increase the proportion of urban population. Give play to the role of urban radiation, attract more relatively low-income people stranded in rural areas to "enter the city", create good urban living conditions for them, and achieve wide coverage of high-quality medical and health care services for the social population in the central and western regions; third, due to the regional heterogeneity of the impact of population aging in the central and western regions on the medical and health care expenditures of rural residents, the western regions, which are relatively backward in economic and social development, should adopt stable socio-demographic policies and economic development measures to cope with the arrival of aging problem.

Second, improve the social security system for rural residents and increase the social accessibility of basic medical care services in the central and western regions. Population aging has become an irreversible trend in China's social transformation. The arrival of an aging society will undoubtedly have a huge impact on the development of Chinese society. Among them, the increasingly severe social medical and health services is one of the impacts. China is

the country with the largest number of elderly people in the world, and the rural elderly population also ranks first in the world, and the rural elderly population is the main body of demand for medical care services. Faced with such a huge expected burden of rural basic medical care services, the Chinese government has introduced many policies and measures, hoping to properly deal with this problem through a complete social security mechanism. Among these social security policies, the new rural cooperative medical insurance system is an effective means to solve the problem of "difficult and expensive medical treatment" in the process of diagnosis and treatment of diseases among the rural masses. After years of development, the new rural cooperative medical insurance system has become an important security system that takes into account the series of medical needs of rural residents.

Due to the decline of physical fitness, the incidence and severity of the disease in the rural elderly population are significantly higher than those in other age groups. Due to low-income levels and weak rural health care infrastructure, the rural elderly population in the central and western regions is caught in the dilemma of urgent need for social health care services and low accessibility. Although the government's total investment in health care in rural areas has increased significantly in recent years with the continuous advancement of the "Healthy Poverty Alleviation" and "Healthy China" strategies, the medical conditions in rural areas in the central and western regions are still weak. Based on this social reality and empirical analysis of the research conclusion that the medical and family planning expenditures in the central and western regions have a significant positive impact on the rural residents' medical and health care expenditures. The article believes that the following three points can be taken to strengthen the construction of the rural residents' medical and health care service system in the central and western regions, improving the social accessibility of basic medical insurance services: first, strengthen the overall planning of medical and family planning expenditure funds at the provincial level in the central and western regions, improve the construction of rural residents' medical and health care infrastructure, and enhance the ability of medical and health care social services; second, innovate the medical and health care service mechanism for rural residents in the central and western regions, optimize the service content, improve the service quality, and realize the facilitation of medical and health care services. Third, improve the social medical insurance system in the central and western regions, strengthen the implementation and supervision of the new rural cooperative medical system, and ensure that rural residents can truly enjoy the social benefits brought by the medical insurance policy.

Finally, accelerate the coordinated and integrated development of the economy and continuously narrow the regional economic gap. The above research shows that socioeconomic development (disposable income of rural residents) has a significant positive impact on rural residents' healthcare expenditures without regional heterogeneity. Therefore, the central and western regions need to continuously strengthen regional economic construction and consolidate the social and economic foundation for the operation of the medical and health care service system. At present, country's economy presents a situation of unbalanced regional development. This is reflected in two aspects: first, the economic differences between the eastern, central and western regions are relatively large; second, the economic differences between urban and rural areas are very obvious. This unbalanced social and economic development will be detrimental to maintaining the value pursuit of fairness and justice in the implementation of rural healthcare-related policies. Based on the social reality and the above empirical conclusions, the article believes that in the process of optimizing the supply of medical and health care services for rural residents, the government departments in the central and western regions need to accelerate the coordinated and integrated development of the economy, continuously narrow the regional economic gap, and achieve high-quality economic development. Specifically, you can refer to the following points: first, give full play to the radiating role of the economic circle of large cities, drive the common development of rural

areas, and accelerate the integration of urban and rural areas; second, resolutely win the battle against poverty and win the building of a well-off society in an all-round way by 2020 grand goals of society. The economic foundation of the poor rural areas in the central and western regions is weak, and the elderly population is one of the "vulnerable groups". The accessibility and level of basic medical care services have a direct impact on their quality of life. Therefore, eliminating absolute poverty in society and improving the economic status of "vulnerable groups" are the top priorities for narrowing the regional economic gap; The development advantage of an open economy allows inland regions to seize opportunities and share the common achievements of reform and opening up and social and economic development. This is a long-term mechanism for building "a game of chess for the national economy" and achieving common development.

5. Conclusion

In the context of the deepening aging of the population, improving the purchasing power of rural residents' medical and health care services is an important measure to improve my country's social pension and medical security system. The availability of medical and health care services for rural residents is an important performance for evaluating the quality of social medical and public services in government departments. By analyzing the panel data of 22 provinces and autonomous regions in the central and western regions of my country from 2000 to 2017, this paper explains the impact of population aging on rural residents' health care expenditures, and draws the following conclusions:

First, population aging in the central and western regions has a significant positive impact on rural residents' healthcare expenditures. It shows that with the deepening of the aging of the social population, the medical and health care expenditures of rural residents in the central and western regions will increase; secondly, the per capita disposable income of rural residents in the central and western regions has a significant positive impact on their medical care expenditures. It shows that social and economic development will increase the medical care demand and purchasing power of rural residents in the central and western regions; thirdly, the medical and family planning expenditures in the central and western regions have a significant positive impact on the rural residents' medical care expenditures. It explains that government policy supply and financial support will improve the accessibility of rural residents' healthcare services in the central and western regions. Different levels of social, economic and cultural development have different effects and paths of different factors.

Acknowledgments

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